PATENT SPECIFICATION 970,595

DRAWINGS ATTACHED.

970,595

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COMPLETE SPECIFICATION.

Machine for Making Perforated Bricks.

We, HARBISON-WALKER REFRACTORIES COMPANY, a Corporation organised under the laws of the State of Pennsylvania, United States of America, of 307 Fifth Avenue, Pittsburgh 22, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to brick making and more particularly to a method and machine for making bricks having holes through them.

The forming of holed brick from free-flowing granular materials presents problems of a difficult nature, which are not encountered in forming such products from plastic deformable clay-type masses or blanks. In the latter type of manufacture a pre-formed blank or "clot", usually formed by extrusion, is fed to a press (frequently called a runner brick press) where it may be readily reshaped and provided with holes by forcing plungers or pins through the plastic mass, while ejecting the plastic material displaced by the pins. This practice cannot be followed with the semi-dry granular materials used in so-called power pressing or dry pressing. If pre-formed, as by the pressing of blanks, the granular pressed units would be brittle and non-yielding, and any attempt to reshape them by piercing would inevitably lead to fracturing or shattering them. The granular pressed ware, with which this invention is concerned is formed at pressure ranging from about 1,000 to 15,000 pounds per square inch.

Although granular power pressing is the most commonly used method of making refractory bricks, almost all of them have been simple plane surfaced shapes without holes. A pressing method which has been tried to some extent, but with great limitations, has been providing a mold chamber containing vertical pins, over which granular batch material is charged before pressing. We have found that the prohibitive brick breakage arising from that process is due to the impossibility of uniformly charging the granular material to so irregular a mold.

According to one aspect of the present invention there is provided a method of making perforated bricks by charging brick-making material into a mold and compressing the material in the mold said method including the steps of introducing perforating members into the charge of material in the mold and smoothing off the top surface of the charge prior to compression of such material.

According to another aspect of the invention there is provided a machine for making preforated bricks comprising a brick-making mold having a perforated base with displaceable perforating members positioned in the perforations in said base and having a displaceable top plate having holes therein in register with the perforations in said base, first means for positioning said members in a withdrawn position with their upper ends near the upper surface of said base and for raising such members from such position to a position in which they extend through the charge of the mold, second means for positioning said top plate clear of the upper surface of said mold and for moving such top plate from such position into the mold to compress the charge therein, third means arranged to slide over the open upper end of said mold to deposit a charge therein and means controlling the operation of said first, second and third means in such a manner that said third means is operated to deposit said charge in the mold when said members are in said withdrawn position, said first means is then operated to raise said members until their upper ends are substantially flush with the upper surface of the mold and then said second means is oper-

[*Price 4s. 6d.*]

ated to move said top plate into the mold to compresss the charge therein.

A preferred embodiment of the invention is hereinafter described, by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 is a side view of a brick-making machine, partly broken away in central vertical section;

Figs. 2, 3 and 4 the enlarged fragmentary vertical sections showing different steps in the process;

Fig. 5 is a further enlarged fragmentary vertical section taken on the line V—V of Fig. 1, showing the mold empty; and

Fig. 6 is a horizontal section taken on the line VI—VI of Fig. 5.

As shown in the drawings, the machine has a pair of laterally spaced side frames 1 and 2, between the lower front part of which a table 3 is rigidly mounted. The table is provided with a rectangular molding cavity 4 that extends completely through it. At the back part of the table there is a hopper 5 that contains the granular material to be used in making bricks. The lower end of the hopper is spaced from the table by a charging box 6, which can be slid forward across the molding cavity by means of a rod 7 pivoted to the back of the box below its rear extension 8 and to an arm 9 suspended from a pivot 10 mounted in the side frames. The arm is swung back and forth by a link 11 that is pivotally connected to it and to the lower end of an arm 12 that straddles rod 7. The upper end of arm 12 is rigidly mounted on a horizontal rock shaft 13 journalled in the side frames of the machine. The lower end of another arm 14 is rigidly mounted on a projecting end of the rock shaft, and the upper end of this arm carries a cam follower roller 15 that travels in the groove of a cam 16 mounted on the inner side of a large gear 17. The gear is rigidly mounted on a projecting end of a crank shaft 20, the ends of which are mounted in bearings 21 in the side frames. The gear is driven by a pinion 22 on one end of a shaft 23 below it. This shaft likewise is journaled in both side frames, and its opposite end carried a gear 25 that is driven by a pinion 26 mounted on a shaft 27 behind it. This rear shaft is journaled in the side frames, from one of which it projects and carries a pulley 28 that is driven by a belt 29 from an electric motor (not shown).

When the charging box 6 filled with granular material is moved across the molding cavity, the material falls into the cavity and fills it as shown in Fig. 1. The material is retained in the cavity by a bottom pressure plate 31 that is supported in the bottom of the cavity by a plurality of vertical parallel bars 32 spaced lengthwise of the plate and supported by a crosshead 33. The latter is supported at its opposite ends by vertical side bars 34 that have enlarged ends guided in their vertical movements between ribs 35 and 36 on the side frame of the machine. The bars can be moved vertically far enough to lift the bottom pressure plate to a level flush with the top of the table. Journaled in the upper ends of the two side bars is a horizontal shaft 37, on which the upper end of a heavy toggle link 38 is pivotally mounted. The lower end of this link is provided with a central recess, in which the upper end of a lower toggle link 39 is disposed. The adjoining ends of these links are connected by a horizontal shaft 42, on the central portion of which the front end of a crank arm 43 is pivotally mounted. The lower end of the lower toggle link carries a shaft 44, the ends of which are mounted in a crosshead 45 that slides up and down in the side frames. This crosshead carries a plunger 46 that supports a top pressure plate 47 aligned with the molding cavity.

The rear end of crank arm 43 is journaled on the offset center of crank shaft 20. As the large gear is rotated, the toggle is straightened and broken by the crank arm, the bottom of which has cam surfaces 48 that move back and forth across a cam roller 49 journaled in the side frames. The action of the press is such that while the bottom pressure plate 31 is at the bottom of molding cavity 4, the top pressure plate 47 can be raised high enough to permit the charging box to move forward and back beneath it, after which the toggle is straightened to move the top pressure plate down into the molding cavity to mold a brick therein. Then the side bars 34 are raised to lift the brick to the top of the cavity while the toggle and crank arm move the top pressure plate upward away from the brick so that the charging box can advance between the two plates again and push the brick forward onto the table in front of the molding cavity. This is the well-known action of a Boyd press.

It is a feature of this invention that during the molding operation vertical holes or passages are formed in the brick to reduce its weight and improve its thermal properties. Accordingly, as shown best in Fig. 5, the top and bottom pressure plates are provided with a plurality of aligned vertical holes 51 and 52, respectively, which in size and number are the same as the holes that are to be formed in the brick. A pin plate 53 is disposed between the bottom pressure plate 31 and its supporting cross head 33 and extends lengthwise thereof. To permit this disposition of the pin plate, it is provided with rectangular openings 54, through which the vertical bars 32 extend. Rigidly mounted on the pin plate are vertical pins 56, corresponding in number and size to the holes 52 in the bottom pressure plate. The pin plate

may be moved up and down on the bars by any suitable means, but preferably by vertical piston rods 57 extending up into hydraulic cylinders 58 mounted in the table at opposite ends of the molding cavity, as shown in Fig. 5. Fluid under pressure can be delivered to either end of the cylinders manually or automatically by any suitable means. In its lower position, the pin plate holds the pins with their upper ends near the upper surface of the lowered bottom pressure plate. In the upper position of the pin plate, the upper ends of the pins are substantially flush with the top of the table as shown in Fig. 2. At least, they should not project above the table because that would interfere with the movements of the charging box.

The operation of the press is as follows. With the bottom pressure plate 31 in the bottom of the molding cavity, the pin plate 53 is moved to its lowest position so that the tops of the pins likewise will be at the bottom of the cavity as shown in Fig. 1. The charging box 6 moves forward to fill the cavity with brick material, but before the charger is retracted the hydraulic cylinders 58 raise the pin plate so that the pins 56 will be forced up through the loose material in the mold to form vertical passages therethrough, as shown in Fig. 2. Then, as the charging box moves back to the hopper, it will carry with it the granular material pushed up out of the mold by the pins. The top pressure plate 47 then descends into the molding cavity to press the material therein into the form of a brick 60 having a predetermined thickness, as shown in Fig. 3. As the plate moves downward it slides down around the raised pins. Following the pressing operation, the bottom pressure plate and the top pressure plate are raised together to lift the brick from the mold and simultaneously strip it from the pins, as shown in Fig. 4. After the top plate has moved upward away from the brick, the charging box moves forward to push the brick onto the front part of the table. The brick, of course, contains a plurality of vertical holes 61 through it formed by the pins.

While the invention has been described in connection with a toggle-actuated press, it is readily applicable to other presses whether mechanical or hydraulic type. It also is applicable to vibration methods of forming. With this invention, perforated bricks can be produced by a brick machine at substantially the same rate as unperforated bricks. Also, the changes necessary in the machine for that purpose are relatively simple and inexpensive.

The granular batches used in forming brick by power pressing are by no means fine powders. This class of ware, instead, utilises a graded mixture of particle sizes from as coarse as 4 mesh, down to much finer grains. By way of example, a batch made from 70% flint clay and 30% semi-hard or plastic clay will commonly show these grain sizes; 30% passing through 4 mesh and held by 10 meth, 20% passing through 10 mesh and held by 20 mesh, 15% passing through 28 mesh and held by 65 mesh, and 35% passing through 65 mesh; the screens referred to being of the standard Tyler series. The industry practices wide latitude in this matter, but for the class of ware described, there would always be some material held on a 14 mesh screen. This distinguishes from the quite unrelated art of making such small pressed shapes as electrical porcelain, which would contain no material coarser than 14 mesh; not generally any particles coarser than even 65 mesh screen. These matters are critical in mold charging problems, since the very fine powders tend to flow like water and therefore present only minimum difficulties.

WHAT WE CLAIM IS:—

1. A method of making perforated bricks by charging brickmaking material into a mould and compressing the material in the mould said method including the steps of introducing perforating members into the charge of material in the mould and smoothing off the top surface of the charge prior to compression of such material.

2. A method as claimed in Claim 1 wherein the perforating members are introduced through apertures in the base of the mould.

3. A machine for making perforated bricks comprising a brickmaking mould having a perforated base with displaceable perforating members positioned in the perforations in said base and having a displaceable top plate having holes therein in register with the perforations in said base, first means for positioning said members in a withdrawn position with their upper ends near the upper surface of said base and for raising such members from such position to a position in which they extend through the charge of the mould, second means for positioning said top plate clear of the upper surface of said mould and for moving such top plate from such position into the mould to compress the charge therein, third means arranged to slide over the open upper end of said mould to deposit a charge therein and means arranged to control the operation of said first, second and third means in such a manner that said third means is operated to deposit said charge in the mould when said members are in said withdrawn position, said first means is then operated to raise said members until their upper ends are substantially flush with the upper surface of the mould and then said second means is operated to move said top plate

into the mould to compress the charge therein.

4. A machine as claimed in Claim 3 wherein said controlling means is arranged to return said third means to its initial position after operation of said first means and prior to operation of said second means whereby to smooth off the upper surface of the charge after insertion of said members and prior to compression of the charge.

5. A machine as claimed in Claim 3 or 4 including fourth means for jointly raising said base and top plate relative to the side walls of the mould to remove a compressed brick from the mould and perforating members.

6. A machine as claimed in Claim 3, 4 or 5 wherein said mould is positioned in a mould table across the surface of which said third means is arranged to slide and said first means includes fluid pressure cylinders mounted in the mould table adjacent the mould.

7. A machine as claimed in Claim 3, 4, 5 or 6 wherein the bottom ends of said perforating members are mounted on a common plate arranged to be raised and lowered by said first means.

8. A machine as claimed in Claim 7 wherein said first means includes a pair of spaced extendable and retractable members connected to opposite ends of said common plate.

9. A machine as claimed in Claim 5 or in Claim 6, 7 or 8 as appendant to Claim 5 wherein said control means is arranged to operate said fourth means to raise said compressed brick out of the mould and then to operate said third means to displace the compressed brick and re-charge the mould.

10. A machine for making perforated bricks substantially as herein described with reference to the accompanying drawings.

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970595 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

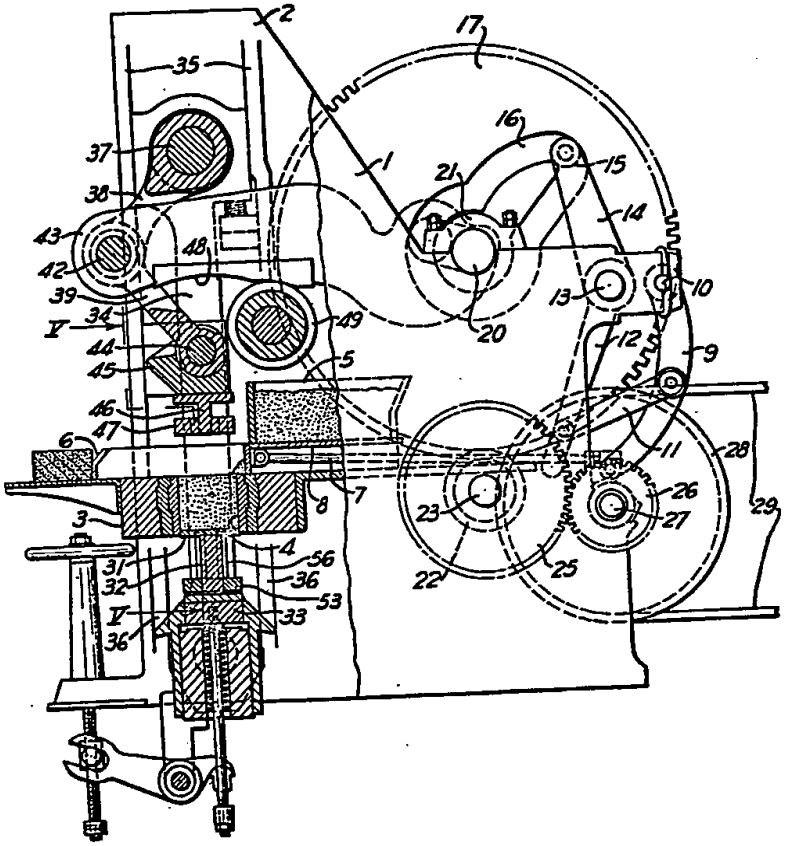


Fig. 1

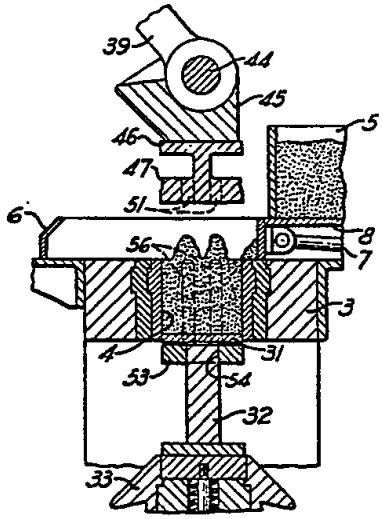


Fig. 2

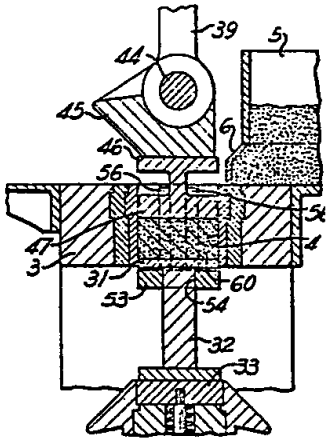


Fig. 3

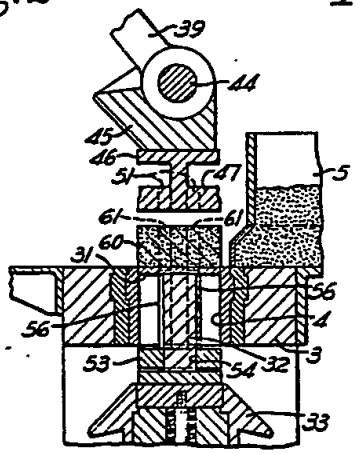


Fig. 4

970595 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 2 & 3

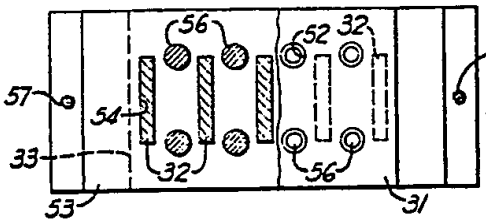


Fig.6

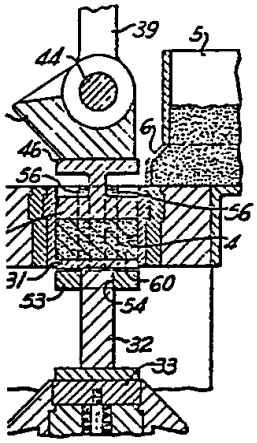
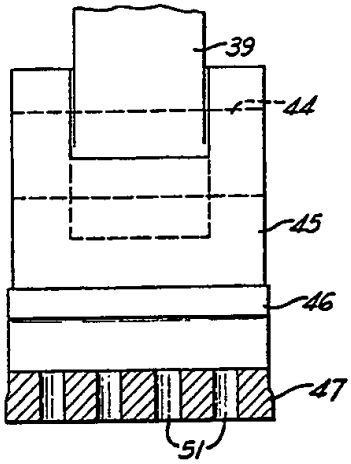


Fig.3



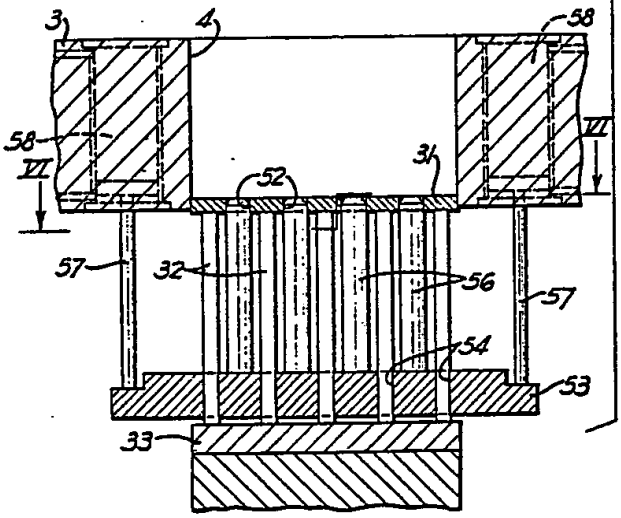


Fig.5

970595 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 2 & 3

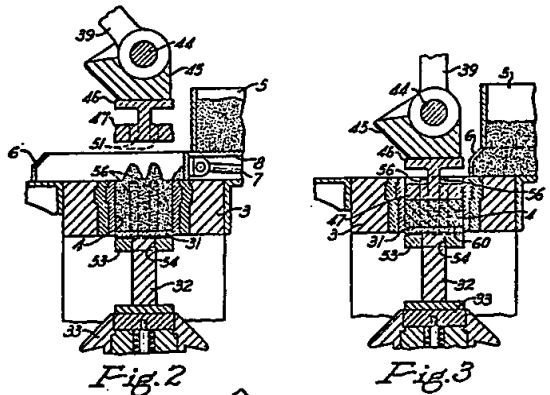


Fig.2

Fig.3

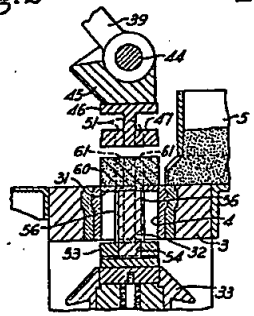


Fig.4

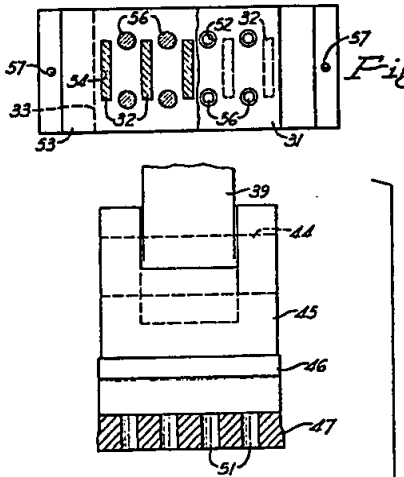


Fig.6

Fig.5